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The Subspecies of the Massasauga, *Sistrurus catenatus*, in Missouri

Philip D. Evans and Howard K. Gloyd*

Since the publication of a monographic study of the rattlesnakes (Gloyd, 1940) a considerable number of additional specimens of the massasauga, *Sistrurus catenatus*, has become available from Missouri. A study of this new material, a total of 67 specimens, has revealed that earlier conclusions as to the region of intergradation between the two subspecies, *tergeminus* and *catenatus*, must be modified. It has also been found that the localities recorded for certain specimens in museums, and some of the distributional records of these rattlesnakes in Missouri, are erroneous or highly questionable. Accordingly, we present here the results of an examination of this new material and a critique of some previously published records.

We are grateful to Kenneth Krumm of Sumner and Paul Anderson of Independence, Missouri, for assistance in obtaining specimens and to Dr. W. T. Garrett of Northwest Missouri State Teachers College, Maryville, for the loan of specimens for study.

As pointed out by Gloyd (*op. cit.*, p. 21, 39, 47), the chief diagnostic differences between the subspecies *tergeminus* and *catenatus* are: (1) the number of ventrals; (2) the number of dorsal blotches; and (3) general coloration, particularly the degree of mottling or blotching of the ventral surface. Another character has been found useful in this study; viz., the dorsal pattern of the head. In *tergeminus* this design is typically an ornate, lyriform figure, symmetrical in most specimens, and usually with the two lateral portions not connected with each other across the posterior frontal and supraocular region (Plate I, Figure 1). In *catenatus* the figure is less symmetrical, the lateral

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portions are more slender, with margins less frequently incised, and the anterior ends usually united across the posterior frontal region and supraoculars (Plate I, Figure 3). In addition to these there are more subtle differences in pattern and coloration, difficult to describe but quite obvious to anyone in the course of increasing familiarity with fairly large series of specimens.

On the basis of the characters enumerated above, it is apparent that the specimens from the extreme western part of the state (Andrew, Holt, Jackson, and Platte Counties) represent the western subspecies, *tergeminus*; those from eastern Missouri (St. Charles County) are typical of the eastern subspecies, *catenatus*; and those from north-central Missouri (Chariton and Saline Counties) are intermediate. The material studied has accordingly been classified as follows:*

Sistrurus catenatus tergeminus (Say)

Andrew Co.—2 miles west of Fillmore, CA 10843.

Holt Co.—5 miles south of Mound City, CA 8612, 8657-63, 8691, 8878-80, 8888, and two specimens loaned by Dr. W. T. Garrett.

Jackson Co.—Swope Park, Kansas City, KU 2317.

Platte Co.—Bean Lake, CA 10756, 10844; East Leavenworth, CA 10757.

Intergrades between *S. c. tergeminus* and *S. c. catenatus*

Chariton Co.—4 miles southeast of Sumner, CA 8197-200, 8611; 5 miles south-east of Sumner, CA 8645-7, 8649-54, 8656; 5 miles south of Sumner, CA 8819, 8886-7.

Saline Co.—Missouri River bottoms, near Miami, CA 11182.

Sistrurus catenatus catenatus (Rafinesque)

St. Charles Co.—Dardenne Prairie, USNM 56246 (Collected by Julius Hurter); CA 8182, 8184; Dardenne Lake, CA 8183, 8185-6, 8189-96, USDA, Biol. Surv. H 4841; Silver Lake, CA 8187-8, 8583-93.

VARIATION IN INTERGRADING CHARACTERS

Characters such as number of scale rows, subcaudals, labials, and tail/to-tal-length ratio in the Missouri specimens do not vary significantly from the summaries given by Gloyd (ibid., p. 34). Therefore consideration here will be given only to those characters in which geographic variation and evidence of intergradation are found.

Variation in number of ventrals in the three series under scrutiny is summarized in Table I. It will be noted that the intermediates from Chariton County more closely approach the western series than the eastern in number

*Museum abbreviations: CA - Chicago Academy of Sciences; KU - University of Kansas, Museum of Natural History; USNM - U. S. National Museum; USDA, Biol. Surv. - Collection of the Fish and Wildlife Service, U. S. Department of the Interior.

of ventrals of both *sexes*, but that the eastern series from St. Charles County average fewer, in line with the general tendency toward reduction in number from west to east (Gloyd, *ibid.*, p. 34, 43, 55).

Table I. Variation in Ventrals

	No.	Males		No.	Females	
		Extremes	Average		Extremes	Average
<i>S. c. tergeminus</i>	9	142-149	145.6	11	146-155	150.4
Intergrades	9	141-149	144.4	10	146-154	150.4
<i>S. c. catenatus</i>	17	136-146	140.4	11	142-149	145.4

Variation in number of dorsal blotches shows a similar pattern (Table II): the intermediates are closer to the western specimens, especially in the males, but again there is a reduction in number from west to east as previously noted (Gloyd, *ibid.*, p. 34, 43, 55).

Table II. Variation in Dorsal Blotches on Body

	No.	Males		No.	Females	
		Extremes	Average		Extremes	Average
<i>S. c. tergeminus</i>	9	34-42	37.6	11	37-50	42.3
Intergrades	9	35-42	37.8	10	33-42	39.4
<i>S. c. catenatus</i>	17	29-37	32.3	11	32-39	35.0

In general, considering the entire species population of *S. catenatus*, *eastern* specimens are darker in coloration and western ones are lighter. This is especially striking when individuals from the geographic extremes of the range are compared. Missouri lies almost in the center of the range, however, and although neither extreme in coloration is evident in examples from this state, the western specimens are conspicuously lighter in color, both above and below, than the intermediates and those of the eastern series. The belly is generally dark (nearly all black or heavily mottled) in those of the eastern series and the intermediates, while in those from the west the light ground color of the belly is less obscured and the dark blotches are more distinct. Ventral coloration apparently varies with age, for in all the young these markings are more distinct, or less diffused, than in adults.

The dorsal pattern of the head, to which reference was made above, is illustrated in Plate I, Figures 1-3. In western specimens the lyre-shaped figure stands out conspicuously, the two longitudinal lateral bars diverging anteriorly on the posterior portions of the supraoculars. In eastern specimens these bars are more nearly parallel and tend to converge and coalesce on the posterior part of the frontal and supraoculars. In the majority of specimens from Chariton and Saline Counties the form of this pattern is intermediate.

ERRONEOUS LOCALITY RECORDS

Among the Missouri localities listed by Gloyd (1940, p. 51) as represented by specimens examined are two that are probably in error: Madison and St. Louis Counties.

Two specimens bearing the data of Madison County, Missouri are numbers 15262-3 in the collection of the American Museum of Natural History. Both specimens were collected by J. W. Mackeldon, August 4-18, 1896. Madison County, Missouri is about 100 miles farther south than the species is known to occur in the eastern part of the state, and suitable habitats are completely lacking in that locality. The entire county is typical of the Ozark Region in which it is located. It is a rocky, hilly area covered with scrub oak and other timber, except where cleared for agriculture and stock grazing. The soil throughout most of the county is Ashe and Clarksville stony loam (Miller and Krusekopf, 1929). This is in sharp contrast with Madison County, Illinois, with its low flat prairies where massasaugas were known to be abundant years ago and are still present in limited numbers, despite the inroads made on their habitat by agriculture. It was in the West Prairie of Madison County, Illinois that Hurter collected 59 of these snakes in two hours in 1890 (Hurter, 1911, p. 210). In 1926, Mr. Mackeldon told one of us (Evans) that he did not know of any of these snakes having been found in Missouri except north of the Missouri River. He also referred to the fact that both he and Julius Hurter had collected numbers of them in the Dardenne Prairie in St. Charles County, Missouri, and in the West Prairie of Madison County, Illinois. Another pertinent consideration is that Hurter (1911) did not include Madison County in his list of Missouri localities. In spite of the fact that Hurter did not mention Mackeldon in his long list of acknowledgments, they are known to have been close friends. Since they collected together a great deal, Mackeldon's material must have been available to Hurter. It is highly probable, therefore, that these two Mackeldon specimens in the American Museum were collected in Madison County, Illinois.

St. Louis County, Missouri is given as the locality of two specimens: Museum of Comparative Zoölogy 6406 and Chicago Academy of Sciences 132. This locality is questionable, although not entirely illogical. Parts of St. Louis County along the Missouri River in the vicinity of St. Charles appear to have suitable habitats for the species, although none of the collectors known to us who live or have lived in St. Louis have ever found massasaugas in the county.

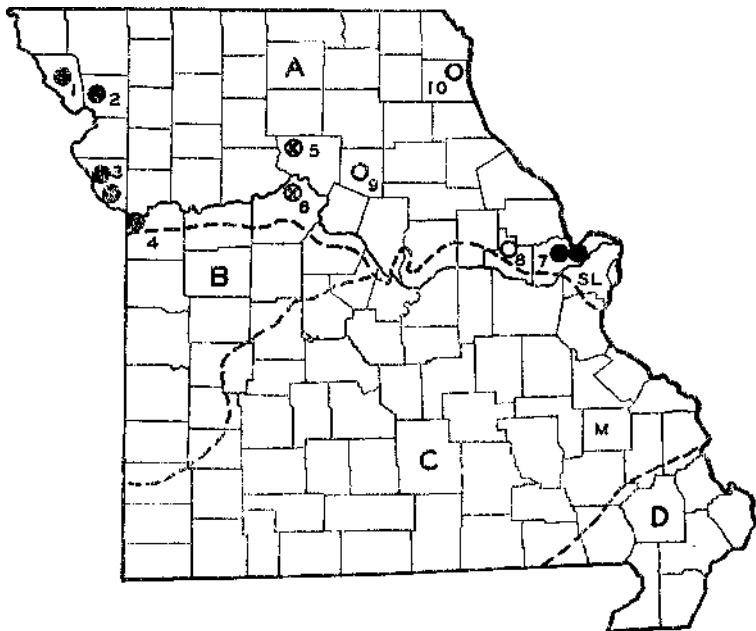


Figure 1. Distribution of *Sistrurus catenatus* in Missouri.

Solid spots indicate *tergeminus* in the west, *catenatus* in the east; crosses within circles, intergrades; open circles, localities reported by Hurter (1911, p. 209).

Numbers indicate counties as follows: 1 Holt, 2 Andrew, 3 Platte, 4 Jackson, 5 Chariton, 6 Saline, 7 St. Charles, 8 Warren, 9 Randolph, 10 Lewis. M indicates Madison County and S L, St. Louis County.

A---North Missouri Glacial and Loessal Region, B—Southwest Missouri Prairie, C—Ozark Region, D—Southeast Missouri Lowland. After Miller and Krusekopf, 1929, P 9.

The specimen in the Museum of Comparative Zoölogy (6406) was collected by Hurter in 1892 and the locality given as St. Louis, Missouri. It is possible that this specimen was entered in the catalog as from St. Louis

because Hurter lived there. In his paper *Catalogue of Reptiles and Batrachians. Found in the Vicinity of St. Louis, Mo.* (1893, p. 258) Hurter wrote, with reference to this species: "So far I have found this snake only on what is known as the 'Wet Prairie,' near Edwardsville, Madison County, Ills." It is not known when Hurter wrote this paper, but it could not have been before 1892 for he refers to Garman's *Synopsis of the Amphibians and Reptiles of Illinois* which was published in that year. This locality is also missing from his list of Missouri localities published in 1911, and in this paper he makes a similar statement (p. 209): "So far I have only found the *Massasauga* at West Prairie, Madison Co., Ill., and at Dardenne Prairie, St. Charles Co., Mo." It is therefore probable that this specimen (MCZ 6406) is one of the snakes from the West ("Wet") Prairie in Madison County, Illinois.

The specimen in the Chicago Academy of Sciences (132) was among the miscellaneous lot of alcoholic reptiles received from Northwestern University in 1931 and has been assumed to have been collected by Robert Kennicott. In an earlier catalog of the Academy it was entered in ink as "Illinois" and over this entry "St. Louis, Mo." has been written in pencil. The space for indicating the collector is blank. Later it was entered in the permanent catalog as "St. Louis, Mo." The reason for the penciled over-script is unknown to us. It now seems advisable to consider this specimen as having no data and to regard the St. Louis locality for this species as highly questionable.

ECOLOGICAL AND PHYSIOGRAPHICAL CONSIDERATIONS

From knowledge of the habitats of the massasauga in other regions as well as in Missouri, it is clear that the species is a lowland form, typical of prairie and plains in the west and of marshy areas and swampy woodlands in the east. It is not surprising therefore that the species is absent from the Ozark Region and apparently confined to the North Missouri Glacial and Loessal Region as defined by Miller and Krusekopf (Fig. 1, A). This region is the southern limit of the glaciated prairie embracing a large part of north-central United States. It is in general a rolling prairie, but level in places, particularly in and near the river bottoms. The elevation in the northwest corner of the state is approximately 1200 feet above sea level, sloping to the east and south to an elevation of 600 feet in the low prairie areas of St. Charles County. Much of the region is covered with loessal deposits. A chain of loess hills runs from Jackson County northward along the Missouri River, forming huge mounds in Holt and Atchison Counties.

The region is traversed by several timber belts, particularly in the east and central portions. It is drained by the Missouri River to the west and south and by the Mississippi River to the east. In the east numerous small

streams flow in a southeasterly direction into the Mississippi River. Southward through the west-central section flow two major tributaries of the Missouri River, the Grand and the Chariton Rivers. These streams are not large but have wide flood basins surrounded by level prairies in Livingston, Linn, Chariton, and Carroll Counties. Numerous sloughs and marshes that have been formed here are thickly populated with reptile life. Similar situations are found in Holt County in the flood basin of the Missouri and Tarkio Rivers and in St. Charles County in the flood basin of the Mississippi.

In addition to the massasauga, two other species of snakes occur in Missouri only in this region: the fox snake (*Elaphe vulpina*) and the plains garter snake (*Thamnophis radix*). The former, like the eastern massasauga, is a species typical of the glaciated prairie region of north-central United States; it occurs in the eastern part of the North Missouri Glacial Region from St. Charles County north. The latter ranges through the major part of the Great Plains, from the Rocky Mountains eastward to Michigan and Ohio, and apparently occurs throughout most of northern Missouri.

The apparent absence of the massasauga from the Southwest Missouri Prairie (Fig. 1, B) is probably due to insufficient collecting in this area. Farmers in southern Pettis County and northwestern Benton County are reported to have killed small "prairie rattlers" occasionally and eventually specimens may be obtained. This unglaciated region is an eastward extension of the Great Plains, a grassland-deciduous forest transition, and in general is flat, open prairie with gently rolling topography in some areas. It lies in the shape of an irregular triangle wedged between the Ozark Region to the southeast and the North Missouri Glacial region to the north. Most of it has an elevation of approximately 900 to 1000 feet, but it reaches about 1150 feet in Cass County and in the southern part of Jackson County. The massasauga is known to occur in similar territory in eastern Kansas and specimens from this area, only a short distance to the west, are regarded as intergrades (Gloyd, 1940, p. 41, 49). It may logically be expected, therefore, that specimens from the Southwest Missouri Prairie would be intergrades between *tergeminus* and *catenatus*.

SUMMARY

Two subspecies of the massasauga occur in Missouri, *Sistrurus catenatus tergeminus* in the west and *Sistrurus catenatus catenatus* in the east, with an intergrading population known from an intermediate area (Chariton and Saline Counties).

The previously published records for the massasauga in Madison County, Missouri are shown to be probably based on specimens from Madison Coun-

ty, Illinois, and the records for St. Louis County, Missouri are questioned.

The massasauga is apparently limited in Missouri to the North Missouri Glacial and Loessal Region, most of which lies north of the Missouri River, and which is similar to the territory occupied by the species in other parts of its range.

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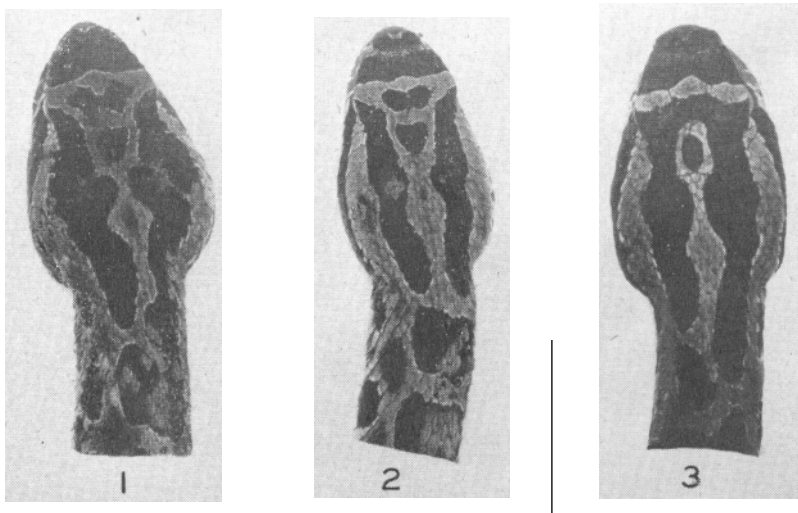


Figure 1. *S. c. tergeminus*, CA 8879, 5 miles south of Mound City, Holt County.

Figure 2. Intergrade, *tergeminus* x *catenatus*, CA 8886, 5 miles southeast of Sumner, Chariton County.

Figure 3. *S. c. catenatus*, CA 8188, Silver Lake, St. Charles County.

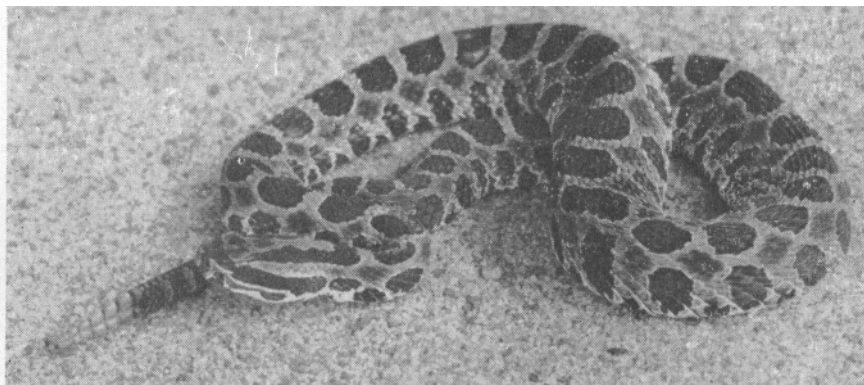


Figure 4. Intergrade, *tergeminus* x *catenatus*, CA 8611, 4 miles southeast of Sumner, Chariton County. Photographs by H. K. Gloyd.